

Coatings  
Corrosion  
Fracture and Mechanical Testing  
High Temperature Mechanical Properties  
Hydrogen Production and Storage Materials  
Hydrogen Separation Materials  
Irradiation  
Materials Validation  
Microstructure and Physical Properties  
Modeling  
Neutron Radiography  
**Nondestructive Evaluation**  
Post-irradiation Examination  
Synthesis and Processing of Novel Materials  
Welding and Joining  
X-Ray Radiography

# Nondestructive Evaluation

## Capabilities/Facilities

**P**ulsed laser acoustic generation, interferometric detection (Fabry P rot, Michelson, Sagnac, photorefractive); picosecond acoustic facility. Noncontacting laser acoustic examination performed down-hole at the Advance Test Reactor's Gamma Tube; photon-induced positron annihilation volumetric and near-surface detection of thermal, fatigue, creep, and neutron and hydrogen embrittlement damage at the Idaho Accelerator Center and with portable systems at INL.

## Materials

High purity metals and alloys, reactor steels, cladding and advanced materials such as nickel superalloys.

## Scientific/Engineering Issues

Acoustic interaction with material microstructure, thin corrosive films and lithographic nanostructures; current damage and long-term life remaining assessments for materials and components subjected to a range of damage mechanisms based on measurements performed at any point in life (precrack); modeling and probability of failure estimates (Weibull distributions).

## Staff

K.L. Telschow, D.H. Hurley, J.B. Walter, D.L. Cottle, R.S. Schley, and D.W. Akers.

## Recent Projects

- Elastic Wave Interaction with Grain Boundaries on a Microscopic Scale, DOE Office of Basic Energy Sciences, \$570K/year
- Laser Ultrasonic Corro-

sion Monitor, Laboratory-Directed Research and Development, \$217K/year

- Shot Peening, Fatigue, and Thermomechanical Damage in Nickel Superalloys, National Science Foundation, \$100K/year

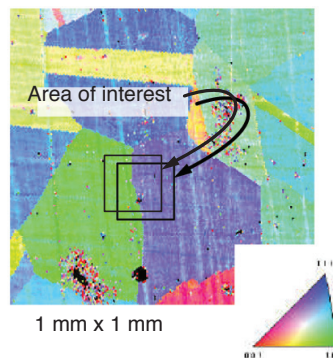
## Collaborations

- Bechtel Bettis
- Johns Hopkins University
- Hokkaido University
- Idaho State University/Lawrence Livermore National Laboratory
- Materials characterization for numerous customers

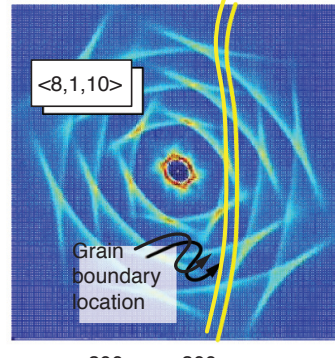
## Publications

"Ultrasonic Imaging of Subsurface Objects Using  
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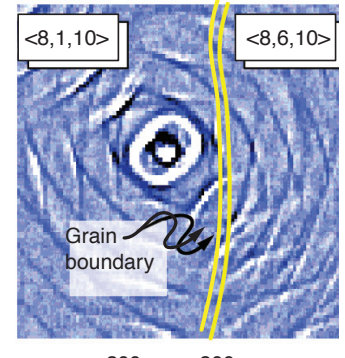
Surface acoustic wave interaction with a grain boundary. In collaboration with the Applied Solid State Physics Laboratory at Hokkaido University, we recently developed a technique to image high frequency surface acoustic waves (~1 GHz) as they propagate across grain boundaries. Measuring linear properties such as reflection and refraction, as well as nonlinear properties such as harmonic content, provides a means to characterize in-situ changes in material microstructure.



False color image of grains in copper sample.



Simulation without grain boundary.



Interferometric image.

Science

**INL**  
Idaho National  
Laboratory

## For more information

**Richard N. Wright, Ph.D.**

(208) 526-6127

Richard.Wright@inl.gov

**Douglas C. Crawford, Ph.D.**

(208) 533-7456

Douglas.Crawford@inl.gov

[www.inl.gov/env-energyscience/materials](http://www.inl.gov/env-energyscience/materials)

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"Full-Field Imaging of Acoustic Motion at Nanosecond Time and Micron Length Scales," K.L. Telschow, V.A. Deason, D.L. Cottle, *2002 IEEE International Ultrasonics Symposium*, October 8-11, 2002, Munich, Germany.

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